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## Consumer support for environmental policies: an application to purchases of green cars

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# JENA ECONOMIC RESEARCH PAPERS



# 2008 – 035

## **Consumer support for environmental policies: An application to purchases of green cars**

by

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Consumer support for environmental policies:  
An application to purchases of green cars

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Abstract

This paper focuses on how consumer motivation can be tapped in order to encourage the adoption of cleaner technologies. Consumers are heterogeneous – they may be guided by intrinsic motivation or extrinsic motivation. While information provision policies (such as the energy label for cars) may be effective in encouraging certain consumers to adopt green cars, financial incentive schemes (such as subsidies or fines) may be more persuasive for extrinsically-motivated consumers. We develop a dynamic theory of adoption of environmental innovations, in which information-provision policies are followed by financial incentives (first ‘carrot’, then ‘stick’ incentives). Analysis of a survey dataset of Swiss households observes considerable heterogeneity in terms of support of information-provision or financial incentive policies, in line with our conjectures. Our results will be of particular interest to policymakers interested in guiding consumers towards cleaner technologies.

**JEL codes:** Q53, Q57, O33

**Keywords:** Environmental policy, Technology adoption, Technology diffusion, Intrinsic motivation, Financial incentives.

## 1 Introduction

The emerging problems of climate change are largely due to the exploitation of new processes made available through technological innovation. However, it is widely believed that technological innovation can also help to meet the challenge of environmental protection. In this paper, we consider the processes of adoption of pro-environmental innovations by individual consumers. Since the environment can be described as a public good, agents lack economic incentives to adopt new technologies that reduce pollution levels. Government policy may thus have a mandate to intervene in the adoption of environmental innovations such as environmentally-friendly cars. It is unclear, however, which policy would be the most effective. At present, the EU Commission's 'three-pillar strategy' (European Commission, 1995) is a combination of voluntary agreements with manufacturers, information-provision policies (including the provision of energy labels), fiscal incentives and financial and legal devices. In this paper we discuss how policies of information-provision and policies of financial and legal incentives can each have their advantages and drawbacks, and that the effectiveness of these different policies is likely to depend on how these policies are combined.

With policies of information provision, consumers are given information on the state of the environment, and on ways how to make consumer lifestyles less harmful for the environment. For consumers to take some sort of pro-environmental action, several factors can be assumed to matter: knowledge about the existence of a problem, knowledge of better options, a feeling of responsibility, and the belief that one's own actions can improve the problem (Schwartz, 1977). But consumers seem to differ quite significantly in these dimensions: they feel responsible to a different extent and they hold different motivations in relation to the environment. In fact, consumers can in principle be categorized into those rather 'intrinsically' or 'extrinsically' motivated to behave in an environmentally friendly way. Participating in an activity out of intrinsic motivation (i.e., without any monetary reward) corresponds to the case of altruistic motives in consumer behaviour.

The standard recipe of economics, i.e. introducing monetary incentives which are assumed to lead to optimal resource allocations, has several shortcomings. Financial incentives alone do not improve the understanding of the problem society faces, and moreover they hinder consumers from taking voluntary action (thus undermining 'democratic' principles). Indeed, the phenomenon of 'crowding out' of intrinsic motivation has been observed to be empirically relevant, pointing to the danger of actually reducing cooperative intentions in consumers by "putting a price on the environment" and introducing a market relationship. To be sure, policy makers should be aware of both intrinsic and extrinsic motivation as forces guiding consumer behaviour.

This paper seeks to analyze consumer opinions towards policy strategies aiming at environmental protection. We are specifically interested to see how consumers react towards policy suggestions, focusing on either information provision or financial incentives or both. Our analysis makes use of a unique dataset on car purchase decisions among Swiss households. We seek to analyze if consumers are willing to support pro-environmental policies, and which consumer groups favour which type of intervention. As such, we address both decisions about technology adoption as well as voluntary curtailment. Our findings will be linked to a dynamic model of technology adoption.

Section 2 contains a brief literature review concerning consumer motivation for green cars. Section 3 contains a theoretical discussion on the topic of how consumers can be

influenced into adopting environmentally friendly technologies. We begin by considering regularities in the diffusion of innovations (Section 3.1), and then discuss (Section 3.2) how individuals differ with regard to enthusiasm for environmental innovations (we discuss the relevance of ‘intrinsic motivation’ for environmental morale). Intrinsic motivation and extrinsic motivation both play important roles in the adoption of clean technologies (Section 3.3). In Section 4 we present the database. Section 5 contains some descriptive statistics. Section 6 presents the results of multivariate regressions. Section 7 concludes

## **2 Literature Review: Consumer Motivation to Purchase Green Cars**

Strategies for encouraging consumers to reduce the ecological impact of passenger transport have been the subject of several studies. Yamamoto et al (2004) provide an empirical analysis of the effectiveness of two policies, introduced by the French government in 1994, aiming at emission control: these include a grant for scrapping old cars (‘acceleration of vehicle retirement’) and an inspection program securing the effectiveness of emission control devices. The authors find that car inspections tend to increase the holding duration of a given car, while the scrapping grant positively influenced the probability of both replacement and disposal. Although consumers find it hard to bring themselves to scrap their old cars, scrapping grants can play an important role in the retirement of old, inefficient cars.

Nijhuis and van den Burg (2007) address the effects of energy-efficiency labels and subsidies on car purchase decisions in the Netherlands. They specifically focus on consumer motivations in the purchase of a hybrid car. They find that sales of the Toyota Prius benefited significantly from the introduction of a tax subsidy amounting to EUR 6000 per hybrid car. When the subsidy was reduced, sales numbers declined. This corresponds to what salespersons revealed in interviews: for consumers the environmental impact of their new car does not seem to rank high on the agenda – it is rather a ‘bonus’ if a car is energy-efficient. Moreover, the study indicated that consumers did not always grasp the meaning of the energy label, which suggests that consumer purchasing habits are not well informed about environmental issues. This is in line with the findings of Kahn (2007) that for buyers of hybrid cars, symbolic values dominate over purely monetary cost-savings due to reduced fuel bills, and that symbolic values are highest for the Prius model.

The Toyota Prius is also the subject of analysis in De Haan et al (2006), where the net effectiveness of energy-efficient cars is under scrutiny. The authors examine two unique types of rebound effect, namely that hybrid cars replace former already energy-efficient and/or smaller cars, or that the adoption of the hybrid car expands car ownership. Based on a survey of Swiss buyers of Toyota Prius, no evidence for these rebound effects can be found. Hence, the authors support policies which seek to enhance the diffusion of hybrid cars.<sup>1</sup>

Peters et al (2008, forthcoming) address the potential impact a feebate system might have on consumer motivations to adopt a more energy-efficient car. Feebate systems imply

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<sup>1</sup> This paper discusses an aspect which we neglect in our analysis on consumer support for environmental policies: the net effectiveness of different policy tools. We only look at one side of the coin, namely which kind of policies meet the consumers’ interests and might thus prove effective when introduced. The other side of the coin is the evaluation of the effectiveness of the policies, by taking into account objective technical facts (energy savings potential, emission reduction potential) as well as the possibility of behavioral responses.

fees for the purchase of energy-inefficient cars, whereas rebates are paid for the adoption of particularly fuel-efficient vehicles. The authors point out that energy efficiency can be viewed from two perspectives: the absolute energy use of a car, and its relative energy-efficiency compared to other cars within the same size class. The latter concept should be more effective, the authors argue, when one assumes that consumers have already made a decision as to which type of car to buy – on the other hand, relative feebate systems might induce switches from smaller to larger cars for those become more economic. The study seeks to assess which feebate system will lead to an overall reduction in energy consumption. The analysis is based on a survey of potential new car purchasers. The authors find that for rebates, consumers show a willingness to change their car choice. Given their findings, the authors support relative feebate systems.

### **3 Theory**

#### **3.1 Diffusion of Innovations**

In this section we develop a dynamic theory of technology adoption in which we frame the switch of consumers to a new cleaner technology. We suggest that the transition to cleaner technologies draws on both intrinsic motivation (a personal sense of responsibility) and extrinsic motivation (financial incentives) in consumer behaviour.<sup>2</sup> To be effective, environmental policy needs to take into account both intrinsic and extrinsic motivation (Frey, 1999; Frey and Stutzer, 2006).

When trying to encourage new technology adoption, policy makers can rely on the well-established theory of the diffusion of innovations developed by Rogers (1995). In the model by Rogers (1995), diffusion is seen as the interplay of a set of heterogeneous individuals, differing in terms of their financial background, social status, knowledge and openness to change. Consumers are categorized in terms of the role which they play in the overall diffusion process (p262). The ‘innovator’ or gatekeeper embraces new ideas, which she can easily adopt due to her financial situation and technological skills. The ‘early adopters’ however are the ones serving as opinion leaders and role models, being a source of advice and information for a larger social network. The groups of ‘early’ and ‘late majority’ take more time for the innovation-decision process once they have received information from their peers. Especially the late majority consumers react to peer pressure to acquire the new innovation. As ‘laggards’ are rather conservative and backward-looking in their consumption behaviour, they stand at the end of a diffusion process, which shows an s-shaped curve (resulting from a normal-distribution of individual thresholds to adoption).

A central element of the stylized diffusion process is the communication process, whereby new information is diffused via the mass media towards opinion leaders who then inform and persuade the masses (‘two step hypothesis’, Rogers 1995, p285). For the technology to diffuse through society as a whole, the connection between social networks, based on heterogeneous actors, is of central importance (the ‘strength of weak ties’, Granovetter 1973). For the adoption of innovations, awareness of the good and persuasion of its usefulness matter (Rogers 1995, p162). A good is also compared to its alternatives such as the former technology: the relative advantage of a new technology decides about its

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<sup>2</sup> Berglund (2005) describes individuals as being both ‘consumers’ and ‘citizens’. Individuals behave as consumers when their consumption decisions are determined by external signals such as the price mechanism. In contrast, individuals can also behave as ‘citizens’ when their behaviour is influenced by their intrinsic concern for the environment.

adoption, encompassing characteristics such as the price and social status. Factors affecting the price of the good thus contribute to increasing its adoption probability. For so-called 'preventive innovations', showing their potential to improve the consumers' situation only sometime in the future, the relative advantage to alternatives is difficult to demonstrate (pp217).

The diffusion theory points to the importance of central leading figures in the process of technology adoption. It emphasizes that information stemming from the media need not reach the masses of consumers for realizing a change; instead the information sources of opinion leaders should be targeted. The central variables guiding consumer behaviour are knowledge, financial constraints and what might be termed "risk preferences". The heterogeneity in motivational states of consumers does not stand at centre stage of this model.

What are the specific incentives that can be used to guide the consumption decisions of leading consumers? This is an important question concerning the adoption of environmentally-friendly consumption behaviour. To investigate this, we will now introduce two different types of motivation – intrinsic motivation and extrinsic motivation. These concepts are distinguished on the basis of whether an individual carries out a specific consumption act out of genuine interest, or because a financial reward can be expected. We then weave these different types of motivation into a theoretical framework of adoption of pro-environmental behavior.

### **3.2 Intrinsic and Extrinsic Motivation**

Intrinsic motivation can be an important source of motivation. If individuals are genuinely concerned about the state of the environment, their behaviour can be guided by 'environmental morale' even if there is a cost involved. Furthermore, research shows that intrinsic motivation can be amplified through the use of communication that supports and reinforces environmental morale - "verbal rewards have a significant positive effect on intrinsic motivation" (Frey and Jegen 2001, p598). There are limits to how far behaviour is affected by intrinsic motivation, however: "people are prepared to follow their environmental conscience provided the cost of doing so is not too high" (Frey, 1999, p404). Although intrinsic motivation can be an important source of pro-social sentiment, "it is difficult to evoke and target, and is neither reliable nor easily sustainable" (Frey 1999, p411). As a result, environmental policy should seek to complement intrinsic motivation with financial and/or legal incentives.

Extrinsic motivation refers to the type of behaviour described in standard economic theory. Individuals are assumed to base their decisions on expected payoffs which can be expressed in monetary terms. Marginal increases in the relative cost of environmentally harmful behaviour can, in principle, induce individuals to adopt cleaner technologies. Polluting behaviour can be deterred through the threat of punishment. The drawbacks of such an incentive system, however, are that people may begin to think of environmental issues by applying a market-based logic. If environmental protection is associated with extrinsic incentives, individuals may start to base their behaviour on the presumption that they have the 'right' to pollute if they bear the associated financial cost (or, in the language of the medieval indulgencies, that 'it is acceptable to sin, as long as you can pay for it'). Any intrinsic motivation to care for the environment would thus be 'crowded out' by a financial logic. Frey (1999) explains how financial incentives can shift the locus of control outside of the person, replacing intrinsic motivation with an extrinsic behaviour that responds to external stimuli (this idea is referred to as 'the cost of price incentives' or 'the

hidden cost of reward'). If individuals' behaviour is controlled by external factors, they view the environment as the responsibility of the government rather than as their own cause. As a result, cooperative behaviour may actually *decrease* after the introduction of financial incentives aimed at encouraging cooperative behaviour.<sup>3</sup> An added danger is that the introduction of price incentives to a specific environment problem may lead them to take on a market-based view of environmental protection in other areas where external incentives are not yet in place (this is known as the 'indirect motivational spillover effect' (Frey, 1999)).<sup>4</sup> These shortcomings of financial/legal tools to control consumer behaviour are amplified by the enormous difficulties of monitoring and sanctioning the behaviour of whole populations of individual consumers, especially when dealing with non-point sources of pollution such as vehicle exhaust pipes.

In addition, the devices of extrinsic motivation will not be successful if they do not enjoy the legitimacy granted by 'democratic' support (i.e. if they are introduced when awareness and concern for environmental issues is still relatively low, and are thus perceived as 'unfair'). For example, there is evidence that public acceptance of road-pricing schemes decreases when these schemes are perceived as unfair (Jakobsson et al, 2000; Fujii et al 2004). Similarly, Hammar and Jagers (2007) observe that respondents who adhere to a fairness principle tend to be more positive to increases in the CO<sub>2</sub> tax.

Environmental policy would benefit from considering both intrinsic and extrinsic factors in consumer motivation. Although excessive legislation and financial incentives can undermine environmental morale, at lower levels they can support intrinsic motivation if they have an 'expressive' role (i.e. if they are instituted to acknowledge cooperative behaviour and let consumers know what is expected of them). "External interventions crowd out intrinsic motivation if they are perceived to be controlling and crowd in intrinsic motivation if they are perceived to be acknowledging" (Frey 1999 p399). Intrinsic motivation also increases when people can participate in decision-making – which suggests that legal and financial devices should be as 'democratic' as possible. Concerning legal devices, it has been suggested that a few, easily comprehensible regulations whose punishments fit the damage done to nature are preferable to a large number of complex, opaque laws (Frey, 1999, p405).<sup>5</sup> In this way the behaviour expected from consumers can be communicated with clarity.

Environmental policy should also take into account the 'cost of price incentives'. Low taxes may play an 'expressive' role and support environmental morale. Low taxes need not crowd out intrinsic motivation if these taxes apply to everyone and are not perceived as 'performance-related' but are instead perceived as fixed costs (Gneezy and Rustichini, 2000). In contrast, high taxes that vary according to the intensity of polluting activity may guide consumer behaviour because of the magnitude of the financial incentives. Intermediate levels of taxation, however, may be counterproductive – they may crowd out environmental morale whilst not being large enough to influence consumption behaviour

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<sup>3</sup> For example, Berglund (2005) considers the attitudes of households to the activity of sorting waste, and writes that "households who take a strong positive moral stance to waste sorting are more likely to ... respond negatively - in the sense of feeling discouraged to undertake more recycling activities - to the introduction of economic incentives in the waste management field" (Berglund, 2005, p.18)).

<sup>4</sup> Similarly, firms may react to mandatory environmental standards by taking a 'legalistic' approach, whereby they focus specifically on meeting the standard but they overlook other actions that might have more significant benefits to the environment (Tenbrunsel et al, 2000).

<sup>5</sup> Unfortunately, however, it would appear that a widespread feature of the legal sphere is that laws tend to be expanded upon with the course of time, such that a simple law can become a complex web of regulations.



(Frey, 1999). To be effective, the introduction of financial incentives should follow the principle of 'pay enough or don't pay at all' (Gneezy and Rustichini, 2000).

As we have seen, intrinsic and extrinsic motivation are two important factors in consumer behavior, that interact with each other in peculiar ways. In the following, we present a dynamic model of adoption of clean technologies that aims to explore the complementarity between intrinsic and extrinsic motivation can be enhanced.

### **3.3 A Dynamic Model of Adoption of New Technologies**

In the following theoretical model, we assume that agents are heterogeneous with regards to their 'environmental morale'. For expositional clarity we suppose there are two groups of consumers - green consumers (who are intrinsically motivated) and mainstream consumers (who are not intrinsically motivated). Furthermore, the model is structured according to two stages. In the first stage, green consumers are encouraged to adopt the clean technology. These green consumers are guided by intrinsic motivation to behave in a relatively altruistic way. In the second stage, mainstream consumers who are more sensitive to extrinsic incentives are targeted with appropriate incentive devices. The intuition behind the model is summarized in Figure 1.

To begin with, all consumers are assumed to use the old, polluting technology (Stage 1). At this stage, there is little awareness of the harmful effects of the old technology. While green consumers have a high level of environmental morale, mainstream consumers are not concerned with environmental issues and respond only to heavy-handed extrinsic incentives. Once they become aware of environmental problems, green consumers self-select themselves towards adoption of the clean technology. After some time has passed, we suppose that there are only mainstream consumers that are still using the old, polluting technology.

In the first stage of the model, policy should provide information to kindle intrinsic motivation. At this stage, the critical matter is to get green consumers to switch to the new technology. All consumers should be made aware of the consequences of their consumption behaviour. The provision of information may be enough to encourage green consumers to use the clean technology. For example, attaching labels to different categories of goods according to their environmental performance can be a useful source of information and a practical and effective aid in the consumer decision-making process (Blamey et al, 2000). Given the initially low level of environmental awareness, however, ideals of environmentally-friendly behaviour do not have a strong popular basis, and so the introduction of taxes or punishment schemes is not possible due to insufficient democratic support. There will be difficulties in sanctioning non-contributors if they don't perceive the law as a fair norm.

As time passes, however, and consumers become more environmentally aware, it might be possible to introduce low levels of extrinsic incentives, as long as their chief role is to encourage and express support to adopters of the clean technology, rather than to control consumer behaviour or fully internalize pollution externalities. At this stage, the green consumers have made the switch to the green technology, whilst the others remain with the old technology. Thanks to the pioneering green consumers, the clean technology has had a chance to become developed and unit costs of the cleaner technology are decreasing, narrowing the gap between the cost of the old technology and the clean technology.

Cultural transmission of consumer behavior may also play a role here, if consumers imitate the pioneering 'green' consumers (Buenstorf and Cordes, 2007).

The critical issue at the second stage is to get the mainstream consumers to switch to the clean technology. As mentioned before, in this model mainstream consumers respond only to extrinsic motivation. As a result, the introduction of financial incentives at this stage does not risk crowding out intrinsic motivation, because we suppose that the green consumers have already switched to the green technology. These financial incentives should be aimed at helping mainstream consumers to take the initiative to switch to the cleaner technology, rather than rewarding green consumers for their past behaviour.<sup>6</sup> Environmental policy should also continue to disseminate information, however, in order to maintain sufficient awareness that the legal and financial devices have a democratic base. Once environmental concern becomes legitimate, and norms of appropriate behaviour are widely recognized, the government now has a mandate to act in favour of the environment, and so high taxes can be introduced.

It is important to follow up the policy initiative of diffusion of information (that occurred in stage 1) with the introduction of extrinsic incentives – otherwise green consumers may lose environmental morale when they observe that mainstream consumers are 'getting away with' non-cooperative behaviour. Instead, the later introduction of financial and legal incentives to adopt the clean technology can be seen as government support and approval of the green consumers' behaviour.

It is also worth considering the different roles of 'stick' versus 'carrot' financial incentives. 'Carrot' schemes may be introduced first as a gentle way of introducing financial incentives as a way of communicating norms of desired consumer behaviour, and rewarding cooperative behaviour on the part of consumers. 'Stick' schemes, such as penalties for the worst polluters, may well receive more popular opposition than 'carrot' schemes, and so these schemes are likely to be more effective if they are introduced at a later date.

### 3.4 Research Questions

The preceding theoretical discussion leads us to formulate some assumptions that will guide our empirical investigations. First, we have emphasized the theme of consumer heterogeneity. Individuals may well have different preferences for different policies. Information-provision policies as well as financial incentive policies can play a role in encouraging pro-environmental behaviour. However, these two policies are quite distinct. While information-provision policies appeal to the intrinsic motivation of consumers, policies relying on financial/legal incentives refer to devices of extrinsic motivation.

In the following empirical analysis, we present some results from the survey and focus in particular on the support individuals give to either information-based policies or policies relying on financial/legal incentives.

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<sup>6</sup> Although financial incentives might crowd out intrinsic motivation at the time of adoption of the cleaner technology, the provision of financial incentives as (unexpected) rewards *after* an intrinsically-motivated decision will probably not be badly perceived by the green consumers, however (Frey and Jegen, 2001, p598).

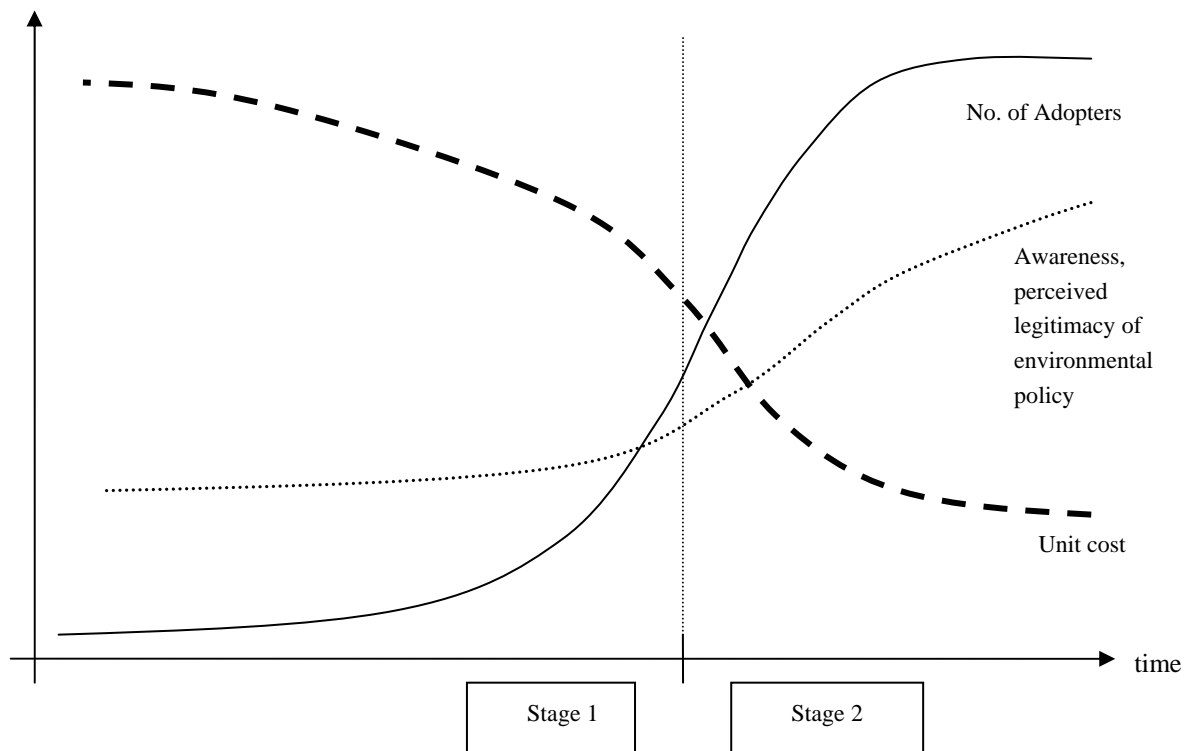


Figure 1: The dynamic process of adoption of clean technologies.

#### 4 Database

In this paper we present results from an analysis of survey data. The survey aimed at collecting information about decision processes and criteria as well as further influencing factors and consumer characteristics, which are supposed to be of relevance for car purchase behaviour, especially with regard to fuel-efficiency of the car finally bought. The survey was conducted in June 2005 among Swiss households randomly sampled from the phonebook. The questionnaire existed in German and in French, for the German- (n=2842) and French-speaking (n=1158) regions of Switzerland. All items from the questionnaire quoted in this paper have been translated in English by the authors. From 4000 questionnaires sent out, 80 were undeliverable and 1581 returned (response rate 40.3%). The 16-page survey consisted of 7 parts. In the present paper, we analyzed the responses to items from part 5 (preferences regarding the next car purchase), part 6 (acceptance of policy goals and measures to reduce CO<sub>2</sub> emissions from individual motorized transport), and part 7 (socio-demographics of the respondent and the household). The survey is described in more details in Peters et al. (forthcoming).

The target of the survey was to obtain a sample representative for Swiss car buyers (either brand-new or second-hand cars). In order to get some idea about the true marginal distributions of available socio-demographic parameters, we constructed a data set of car transactions out of governmental car registration data. A car deregistration followed, or preceded, within 14 days by a car registration, where the official owner has identical birth year and zip code (the only socio-demographic data available in Swiss car registries), was identified as a car transaction (i.e., replacement) by the same individual. This got us frequency distributions regarding age and geographical regions of car buyers (to be exact:

of car buyers previously already owning a car), which were then used to draw a stratified sample out of the Swiss 2000 census data. We then were able to validate the representativity of our survey sample by comparing it to the stratified sample out of the census data. The main results are that single households are underrepresented and that higher income/higher education households are overrepresented, as had to be expected. Therefore statistical analyses of the survey data can be considered as being representative for the entity of Swiss car buyers if they are stratified regarding, or include as independent variable, household type and degree of education.

## 5 Support for Environmental Policies: Descriptive Statistics

This section will provide evidence that the majority of consumers is favourable towards government policies which aim at the protection of the environment. At the same time, a large heterogeneity of opinions can be found considering what the best policy is.<sup>7</sup>

Before turning to consumer opinions, here are the general characteristics of the analyzed sample of households. The total of respondents amounts to 1,581 of which about 65% are male and 33% female. About 40% of respondents are aged 40 to 59 years, about 28% are 17 to 39 years, and 32% of the consumers were aged 60 or older. The median household earns EUR 4000 to EUR 5350 a month. The subsample of those households intending to buy a brand-new car has median monthly earnings of EUR 5350 to EUR 6650. Detailed information on the distribution of income and household size can be found in Tables 1 and 2 in Appendix 1.

90% of the respondents possess a driving license and 86% are active car drivers. The majority does not participate in car sharing (95%). About 60% of respondents drive to work. 40% of the consumers do not possess some kind of subscription/season ticket for public transport. Most consumers possess one car (55%), whereas 28% own two and 5% three cars. 75% of respondents have already bought a car twice or more.

### 5.1 Car Purchase Plans

An energy labelling scheme for new cars at the point of sale, in analogy to EU directive 1999/94/EC, is in force in Switzerland since 2003. Cars are binned into seven categories from highly energy-efficient (A) to very inefficient (G). The underlying concept of energy-efficiency puts fuel consumption in relation to the curb weight of the vehicle, hence also mid-size cars may be eligible, though to a lesser extent, for the “A” label (de Haan et al. 2007b).

When asked about the energy label of their latest car, 74% of respondents did not give an answer and 16% openly said that they do not know. 2% of consumers say it is labelled A and 3.3% claim that it belongs to category B. It should be noted, however, that only respondents having bought a brand-new car since 2003 could have been confronted with the new energy labelling scheme.

About 71% of the respondents are “definitely” or “likely” planning to buy a new car (either brand-new, or second-hand) within the next ten years; 10% reported definitely not to

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<sup>7</sup> All income data reported in the present paper is in EUR, using a CHF/EUR exchange rate of 1.50, which roughly corresponds to the historical exchange rate at the time the survey was conducted (1.52).

plan on buying a new car. Of those who are looking for a new car, two thirds will buy one either within the next two years (33%) or within the next three to four years (29%). For 86% of the consumers who will purchase a new car “definitely”, it is a replacement; only for 4% it is an additional vehicle. For 36% of the respondents who will buy a new car is it a necessity for getting to the workplace, 24% report to need it for their spare time, whereas 11% depend on it for doing (grocery) shopping.

All consumers (not only the ones planning on buying a car for sure and very soon) have been asked about their general preferences when purchasing a car. They had to depict the ranking of certain characteristics that are likely to affect the decision making process. The car size ranked first (26%) or second (27%) for 54% of consumers. 40% named fuel use as first (7%) or second (33%) priority. The emission level of regulated pollutants however meant first priority only to a smaller part of respondents (3%), it is ranked second priority for 10% of consumers.

61% of all consumers claimed to know the energy label with seven categories from A to G increasingly applied in the EU (and in Switzerland) for household appliances; however, only 26% have heard of energy labels on cars. Of those consumers who claimed to be buying a new car for sure, 35% of respondents reported that the energy label would be “important” for their purchase decision of a new car (“very important” is the highest category); almost half of the consumers who are going to acquire a vehicle with certainty were indifferent towards energy labels with regard to their purchase decision (47%).

A more detailed question assessed for which kind of consumption decision a premium would be an attractive policy: would a premium of ca. EUR 1350 induce consumers to purchase a car with a smaller engine or a smaller car in general? Here, different suggestions had to be evaluated on a five-rank ordinal scale. They could either choose “not useful at all”, “very useful” or something in between that was not named specifically in the questionnaire. In order to present our results, we give names to these categories as well: “not useful”, “indifferent”, and “useful”.

not useful at all	not useful	indifferent	useful	very useful
1	2	3	4	5
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Altogether, no extreme responses were given; the share of respondents which “do not agree”, are “indifferent” or “agree” is very similar for the majority of suggestions. The following table summarizes the results.

Table 1: Attractiveness of premium (share of respondents in per cent, adjusted)

<i>Policy suggestion</i>	<i>do not agree at all</i>	<i>do not agree</i>	<i>indifferent</i>	<i>agree</i>	<i>agree absolutely</i>	<i>Obs</i>
<i>Changing to smaller engine for premium.</i>	0	26	41	33	0	100% 694
<i>Changing to smaller car for premium.</i>	0	32	36	32	0	100% 714
<i>Premium would not affect my decision.</i>	0	36	35	29	0	100% 674
<i>Premium would induce me to buy additional features.</i>	0	31	46	23	0	100% 647
<i>I would change from gas to diesel for premium.</i>	0	23	46	31	0	100% 535
<i>For a premium, I would buy a fuel-efficient but larger car.</i>	0	28	42	30	0	100% 687

## 5.2 Responsibility for Environmental Protection

Consumers have been asked about which kind of policies they would give priority in order to reduce CO<sub>2</sub> emissions. This question basically tries to find out, if consumers feel responsible themselves, or if they prefer car producers to take the lead (Schwartz, 1977; Stern et al, 1999). The following table depicts which share of consumers gave first priority to the respective suggestions. Thereby, consumers could name up to two suggestions as first priorities.<sup>8</sup> Those policies which demand the initiative of consumers have been given first priority by about one fifth up to more than one third of the consumers. Producers further improving the fuel efficiency of cars has however been seen as first priority for more than half of the respondents (58%). This suggests that consumers do not feel entirely liable for environmental damage brought on by their consumption acts, since a large share of the responsibility is instead attributed to producers.

Table 2: Consumer priorities (share of respondents in per cent, adjusted)

<i>Policy suggestion</i>	<i>...given first priority (%)</i>	<i>....given second priority (%)</i>	<i>...opposition to suggestion</i>
<i>Consumers driving less.</i>	34	22	11
<i>Less second or third cars.</i>	25	23	9
<i>Purchasing more fuel-efficient cars.</i>	30	35	2
<i>More consumers using "alternative" fuels.</i>	32	27	2
<i>Less SUVs.</i>	22	23	10
<i>Car producers building more fuel-efficient cars.</i>	58	22	2

<sup>8</sup> Therefore, the rows do not add up to 100%.

### 5.3 Information Policies

Then respondents have been asked to evaluate the usefulness of different potential policy measures for achieving a reduction in fuel use. Again, consumers had to give their answer based on a five-rank ordinal scale.

Respondents were asked how useful they considered it “to provide more information on the problem of high fuel use” (I.1) or “to provide more information on which cars are economic on fuel use and which are not” (I.2). Obviously, these questions differ in terms of their specificity. In what follows, we only present the most salient results.

Ad I.1) About one third of respondents evaluated I.1 as “very useful”. About one quarter was indifferent.

Ad I.2) The very largest part of consumers wants to have more information on fuel-saving cars: about 54% of respondents chose the second highest category i.e. “useful”. Indifferent have been 33%.

### 5.4 Financial Incentive Policies

As financial incentives, an increase in fuel prices had to be assessed (of EUR 0.13 per liter), thereby it was suggested to increase the price independent from (M.1), or in combination with, a redistribution to consumers through reduction in health insurance premiums (M.2). Moreover, premiums for fuel-efficient cars had to be discussed: should a premium be paid when purchasing a fuel-efficient car (M.3) or shall those who buy a fuel-intensive car have to pay a fine of about the same amount (M.4)?

Ad M.1) Almost half of the respondents thought that the increase in fuel prices is not useful at all (47%). Those who considered this a “very useful” policy on the contrary only amount to about 9%.

Ad M.2) No extreme answers are given to the second suggestion. In fact, 41% of the consumers showed indifference.

Ad M.3) Almost 40% of the respondents were indifferent towards premiums; but about the same amount (39%) considered it “useful”.

Ad M.4) As in the case before, the largest part of respondents were indifferent (38%) towards a fine. Those consumers finding the measure in particular “not useful” amount to the same number as those finding it “useful” (30-32%).

### 5.5 Interrelations between Information-based Policies and Financial Incentive Policies

Next we were interested to see, how many consumers favoured a mix of monetary and information based policies, and if there were some consumers who strictly oppose financial instruments (figure 2).

We mentioned above that the two policy suggestions on information provision are slightly different: one is related to problem awareness more in general (I.1) whereas the other one is directly related to specific cars (I.2). *In what follows, we will concentrate on I.1.* Of those who found I.1 very useful (one third of consumers) about 43% strongly

opposed *higher fuel prices*. Only 12% of those who were very positive about information provision also supported higher fuel prices. This group makes up less than 4% of the total of respondents. A smaller fraction of consumers (nearly 6%) had strong objections against information provision (“not useful at all”); out of this group, nearly two thirds also objected higher fuel prices. This latter makes 4% of total respondents, being against both information and higher fuel prices.

These results differ quite substantially from the answers to the policy suggestion that combines higher fuel prices with redistribution to the consumers. No respondent judged this policy as “not useful at all” (also nobody considered it “very useful”), no matter what they thought about information provision. Most salient is that half of the consumers who very much favoured information policy I.1 were indifferent towards redistributed higher fuel prices.

How do consumers evaluate *premiums* for efficient cars? No extreme answers were given here, both in the case of support for information provision and rejection of information policies; but a large part (i.e. 46%), although they had strong opinions about information policies (“very useful”), seems to be indifferent towards premiums. Those consumers who strongly support information provision and consider premiums as “useful” amount to about 8% of the total.

How do consumers evaluate *fines* for inefficient cars? The largest part of those consumers who were very positive about information (“very useful”) was indifferent towards fines (41%). Again, no extreme positions towards fines seem to exist. Consumers being very positive towards information and also open towards fines (“useful”) made up 8% of the total. Of those who have opposed information provision, 50% also consider fines as “not useful”.

Individuals display heterogeneity with regard to support for various policy initiatives. Although we tried to divide individuals into those who supported information-based policies as opposed to financial-based policies, there is some overlap between these two groups, as well as frictions within groups (Figure 2).



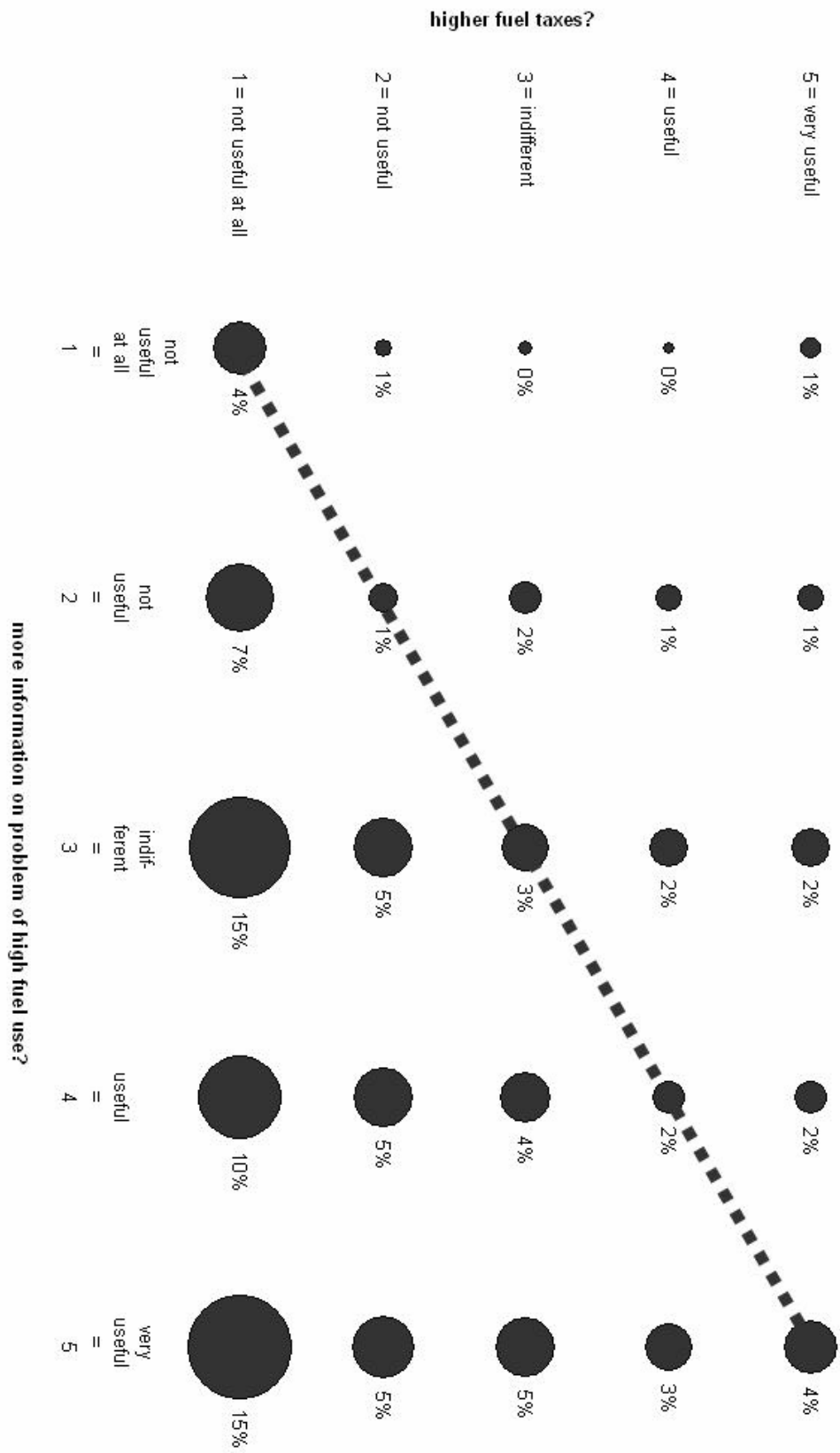


Figure 2: A cross-tabulation of consumer support for more information on high fuel use (an information-provision policy) and higher fuel taxes (a financial incentives policy).

## 6 Multivariate Analysis

The aim of the following analysis is to determine the characteristics of consumers who express support for information-based or financial policies.

### 6.1 Correlations

The correlation matrix of the 7 dependent variables (3 information policy variables and 4 financial policy variables) used in the following regressions is presented in Table 3 in Appendix 2.

There is a significant positive correlation between responses to information-based policies, although the correlations are not very large. Correlations between responses to the financial incentives-based policies are often positive and significant. Cross-correlations between responses to information- and financial incentives-based policies are often not statistically significant, and in two cases they are negatively related to each other at a statistically significant level. This suggests that those individuals that support information-based policies are not necessarily the same as those who support financial incentive-based policies. (We remind the reader that the questionnaire is constructed in such a way that a response for one policy has no immediate impact on responses concerning support for another policy (i.e. there is no implicit ‘trade-off’ between responses).)<sup>9</sup>

### 6.2 Regressions

When doing regressions with a dichotomous dependent variable, we use the standard probit and logit models (robust for heteroskedasticity). For count data models, Poisson regressions are preferable to OLS regressions in many cases where the dependent variable is an ordered array of integers. The poisson distribution assumes that the mean is equal to the variance – if the mean is less than the variance (i.e. the case of ‘overdispersion’) the poisson model is not appropriate and we would prefer the (generalized) negative binomial regression estimator. In our case, however, we don’t observe overdispersion (instead we have under-dispersion). We base our inference on the OLS and poisson estimators (robust for heteroskedasticity). These two estimators give similar results in all cases, however.

Regression results are presented in Tables 4 and 5 in Appendix 4, and a list of variables can be found in Appendix 3. From a list of candidate variables, we retained explanatory variables that were either statistically significant or, failing that, of particular interest for this paper. The more explanatory variables we have, the fewer the number of observations, such that statistical significance of the regression coefficients becomes less likely. Furthermore, specific coefficient estimates are likely to vary slightly across specifications because of differences in sample composition associated with differences in number of observations.

In what follows, we will show which type of consumer support which policy suggestions.

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<sup>9</sup> In an attempt to group individuals into groups according to their support for information policies or financial incentive policies, we applied cluster analysis techniques. Preliminary explorations with hierarchical clustering methods, using several linkage techniques, appeared to be unable to make meaningful groups of individuals, however. This underlines the heterogeneity in responses in terms of the support individuals gave for the different policies.

Table 3 Consumer Characteristics and Policy Support – Rergression Results

**Should manufacturers give more information on energy efficient cars?**

Older individuals and females express support for this proposal. Less-educated individuals, also tend to support this policy. While those traveling to work by car were against it, those traveling by public transport expressed support. Individuals supporting the policy of raising fuel prices also were more likely to support this policy. Furthermore, it is interesting to observe that those individuals who indicated the energy label would play a role in their next car purchase decision were favourable to this policy.

**More general information on how fuel consumption can be reduced?**

Older individuals and women expressed support for this. Similarly, households with few children, as well as more educated individuals, supported this policy. Individuals who would appreciate having more information from car manufacturers (variable '*mehr\_info*') as well as those supporting price increases for petrol supported this initiative. Individuals who indicated the energy label for cars would play a role in their next purchase decision supported this policy.

**More information on which cars have high and low fuel consumption?**

Opposition to this policy was expressed by older individuals (who incidentally are more likely to be buyers of brand-new cars). In contrast, individuals that spend a long time travelling to work were supportive of this. This policy was also supported by wealthier households, amongst others

**Raising the price of fuel?**

This policy received support from several groups: females, wealthier households, and those traveling to work by bike. It was opposed by those traveling to work by car, as well as those households with multiple cars. Individuals who supported the policy of producers giving more information also were likely to support this initiative.

**Raising the price of fuel and redistribution by lowering health insurance premiums.?**

Women and wealthier households expressed support for this policy. (Oddly enough, those traveling to work by bike were relatively opposed to it.)

**Incentive of EUR 650 up to EUR 1350 for buyers of energy efficient cars?.**

This policy was supported by wealthier households. It was opposed, *ceteris paribus*, by those who have already purchased a car during their lifetimes (and who therefore might have more experience of the car-buying decision!).

**Fine of EUR 1350 for those with polluting cars?**

This policy was supported by older individuals, which contrasts with earlier regressions (with *mns\_infaut* as dependent variable) indicating that older individuals were relatively opposed to more information on the pollution levels of cars. This policy was also supported by wealthier households and by mobile individuals (likely to move in the near future).

To sum this up, multivariate regressions reveal that women were generally more favourable to men with regard to policies relying on both information provision and financial incentives. Older people were supportive of information policies but were less supportive of financial incentive schemes. Richer households, in contrast, were relatively favourable to financial incentives although they did not display any discernable support for information policies. Furthermore, those that spend a long time travelling to work may be relatively favourable to both information and financial incentive policies.

Subjective responses on the importance of the energy label in the choice of a new car were positively associated with support for information-provision policies, for two of our three dependent variables. This is an encouraging result, because it is consistent with the hypothesis that individuals who are genuinely concerned about the environment and are relatively well-informed of environmental issues tend to support information-provision policies. We did not detect any influence of this variable on support for financial incentive policies, however.

## 7 Conclusions

In this paper we analyzed to what extent consumers are willing to support public policies aiming at limiting polluting emissions from cars. We began with a theoretical discussion in which voluntary pro-environmental behavior brought on by ‘intrinsic motivation’ was contrasted with enforced compliance to financial and legal incentives (the case of extrinsic motivation). Taking car purchase decisions as an example, and drawing upon a unique dataset of about 1,500 Swiss households, we investigated the responses of consumers to proposals of information-provision and financial incentive policies. In line with our conjectures we observed significant consumer heterogeneity in terms of support for these policies.

We compared consumer support for either information provision policies and/or financial interventions (the latter consisting of higher taxes on fuel, and subsidies or fines in relation to the energy-efficiency of cars). The Swiss dataset revealed that the majority of consumers is in favour of some kind of public intervention for environmental protection. To begin with, more than half of the participants expressed an opinion about the manufacturers' responsibility for further improving the fuel efficiency of cars. At the same time, they saw a lack of information, as more than half of the respondents also supported information provision on such efficient cars (i.e. 54% of respondents categorized this as "useful" which is the second highest category). About one fifth of the total of respondents highly supported information provision policies. The increase in fuel prices was objected to by about half of the respondents, calling it “not useful at all”. Putting this in context with information policies: of those consumers considering information provision as very useful (one third of respondents), about 43% strongly opposed higher fuel prices. The group of consumers who seem to be highly motivated towards environmental protection, thus being very positive about information provision to the public as well as supporting higher fuel prices amount to 4% of the total. This group is opposed with a 4% share of respondents objecting to both information provision and monetary incentives in the form of higher fuel prices. Of those consumers having opposed information provision, 50% were also very critical about fines, thus calling it “not useful”.

In multivariate regressions we sought to explain preferences for specific policies (information provision or financial/legal incentives) by looking at consumer characteristics. In many cases, individuals that took a favourable stance towards one of the policies were less favourable to the other policy. Indeed, the two policies were not seen as complementary but had different appeal to different questionnaire respondents.

It is usually taken for granted that public policies are welcome by some parts of the population but not by others. However, for the overall effectiveness of policy measures it matters to what extent which kind of motivations are present within a population. Concerning information policies, there are two distinct ways to interpret support for these measures: first, support can be seen as the legitimacy for environmental regulations with a monetary dimension. Providing information about ecological problems and giving consumers ideas on how to relieve the situation is a very ‘democratic’ approach towards environmental protection, for consumers as well as firms are first given a chance to draw their own conclusions before being restricted by the law. A second argument for information policies stems from acknowledging the heterogeneity of individuals in terms of their environmental motivations. In contrast to financial tools, information provision does not run the risk of crowding out intrinsic pro-environmental motivation.

Interpretation of our results is obscured, however, by the possibility of strategic thinking on the part of respondents. First, consider the information-provision policy. Respondents expressing support for this policy will include those who genuinely believe that information provision is a worthwhile policy. However, this category of respondents may also include those ‘cheap talkers’ who consider this a relatively harmless policy that will cost them nothing.<sup>10</sup> To the extent that support for information-provision policies is merely a manifestation of goodwill and cheap talk, it may be more instructive to concentrate on the responses concerning financial incentives. Second, it may be the case that intrinsically-motivated respondents suspect that the majority of consumers are extrinsically-motivated (i.e. unlike themselves) and so they may behave strategically and support policies of financial incentives, even though such policies are likely to be relatively ineffective when imposed upon these intrinsically-motivated individuals. The possibility of strategic responses along these lines makes it difficult to associate support for either information or financial incentive policies with groups of intrinsically or extrinsically motivated individuals.

Further research analyzing the knowledge of environmental issues already possessed by individuals would appear to be worthwhile.<sup>11</sup> It would be interesting to take a closer look at the pro-environmental behaviour of people with more knowledge of environmental issues, and also their perceived effectiveness of information-provision policies. In addition, we would welcome more information on the role of consumer heterogeneity in the diffusion process, as well as dynamic datasets describing the adoption of pro-environmental cars (as opposed to the cross-sectional dataset featured here).

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<sup>10</sup> In other work, we are currently investigating this ‘cheap talk’ hypothesis of support for information provision policies (see Coad et al 2008b).

<sup>11</sup> It should not be overlooked, however, that the government (as well as other agents) provides a large amount of information to consumers on a wide range of other environmental issues, and that this information competes for consumer attention.

### Acknowledgements

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### References

Berglund (2005). Burning in Moral, Drowning in Rationality? Ethical Considerations in Forming Environmental Policy, *Minerals and Energy* 1: 16-22

Blamey, R.K., Bennett, J.W., Louviere, J.J., Morrison, M.D., Rolfe, J., 2000. A test of policy labels in environmental choice modelling studies. *Ecological Economics* 32, 269-286

Buenstorf, G., Cordes, C., 2007. Can Sustainable Consumption Be Learned? Papers on Economics and Evolution 2007-06, Max Planck Institute of Economics, Evolutionary Economics Group.

European Commission (1995). *Community Strategy to Reduce CO<sub>2</sub> Emissions from Cars and to Improve Fuel-Efficiency*. COM(95)689, approved by European Council in June 1996.

Frey, B. (1999). Morality and Rationality in Environmental Policy, *Journal of Consumer Policy* 22: 395-417

Frey, B., and R. Jegen (2001). Motivation Crowding Theory, *Journal of Economic Surveys* 15 (5): 589-611.

Frey, B. and A. Stutzer (2006). *Environmental Morale and Motivation*, Institute for Empirical Research in Economics working paper 288, University of Zurich, April 2006.

Fujii S., Gärling, T., Jakobsson C., Jou, R.-C., 2004. A cross-country study of fairness and infringement on freedom as determinants of car owners' acceptance of road pricing. *Transportation* 31, 285-295.

de Haan, P., and Keller, M. (2000). Emission factors for passenger cars: application of instantaneous emission modelling, *Atmospheric Environment* 34: 4629-4638.

de Haan P., Mueller M. G., Peters A. (2006). Does the hybrid Toyota Prius lead to rebound effects? Analysis of size and number of cars previously owned by Swiss Prius buyers, *Ecological Economics* 58: 592-605.

de Haan P., Peters A., Scholz R.W. (2007a). Reducing energy consumption in road transport through hybrid vehicles: Investigation of rebound effects, and possible effects of tax rebates, *Journal of Cleaner Production* 15: 1076-1084.

- de Haan P, Mueller M.G., Peters A., Hauser A. (2007b). Lenkungsabgaben zur Senkung des CO<sub>2</sub>-Ausstosses beim Neuwagenkauf: Hintergrund, Mechanismen, Prognosen, Bundesamt für Energie, Bern, Schweiz, Dezember 2007.
- Hammar, H., Jagers, S C., 2007. What is a fair CO<sub>2</sub> tax increase? On fair emission reductions in the transport sector. *Ecological Economics* 61, 377-387.
- Gneezy and Rustichini (2000). Pay enough or don't pay at all, *Quarterly Journal of Economics* 115 (3): 791-810.
- Granovetter M. S. (1973). The Strength of Weak Ties, *American Journal of Sociology* 78: 1360-1380.
- Jakobsson C, Fujii S., Gärling, T., 2000. Determinants of private car users' acceptance of road pricing. *Transport Policy* 7 (2), 153-158.
- Kahn M.E., 2007. *Do greens drive Hummers or hybrids? Environmental ideology as a determinant of consumer choice*, *J. Environmental Economics and Management*, 54: 129–145.
- Peters A., Mueller M.G., de Haan P., Scholz R.W. (forthcoming). Feebates promoting energy-efficient cars: Design options to address more consumers and possible counteracting effects, forthcoming in *Energy Policy*.
- Rogers, E.M. (1995). *Diffusion of innovations*, fourth edition, New York and other cities: The Free Press.
- Schwartz, S.H. (1977). Normative Influences on Altruism, in: Berkowitz, L. (ed.), *Advances in Experimental Social Psychology*, Vol. 10, 221-279, New York: Academic Press.
- Nijhuis, J.; van den Burg, S. (2007). Consumer-oriented strategies in new car purchasing, Conference Proceedings: Workshop of the Sustainable Consumption Research Exchange (SCORE!) Network, Cases in Sustainable Consumption and Production, Paris 2007, pp. 241-257.
- Stern, P. C., Dietz, T.; Able, T.; Guagnano, G.A.; Kalof, L. (1999). A Value Belief Norm Theory of Support for Social Movements: The Case of Environmentalism. *Human Ecology Review* 6(2): 81-97.
- Tenbrunsel AE., Wade-Benzoni K. A., Messick D. M., Bazerman, M. H., (2000), Understanding the Influence of Environmental Standards on Judgments and Choices, *Academy of Management Journal* 43 (5): 854-866.
- Venkatachalam, L., 2008. Behavioral economics for environmental policy. Forthcoming in *Ecological Economics*.
- Yamamoto, T., Madre, J-L., Kitamura, R. 2004. An analysis of the effects of French vehicle inspection program and grant for scrappage on household vehicle transaction. *Transportation Research Part B*, 38, 905-926.

## Appendix 1: Summary Statistics

Table 4: Household Size

<i>Number of persons</i>	<i>Frequency</i>	<i>Percent</i>	<i>Cumulative percent</i>
1	415	30.20	30.20
2	563	40.98	71.18
3	167	12.15	83.33
4	229	16.67	100.00
total	1,374		100.00

Table 5: Household Income

<i>Income</i>	<i>Frequency</i>	<i>Percent</i>	<i>Cumulative percent</i>
Less than 2000	21	1.54	1.54
2000-4000	168	12.33	13.87
4001-6000	323	23.70	37.56
6001-8000	302	22.16	59.72
8001-10'000	223	16.36	76.08
10'000-12'000	139	10.20	86.28
12'001-14'000	85	6.24	92.52
More than 14'000	102	7.48	100.00
total	1,363		



## Appendix 2: Correlation Matrix

Table 6: Correlations and Cross-Correlations

		mehr_info	mns_infpr	mns_infaut	mns_hhpr	mns_hhkk	mns_prm	mns_abga
coeff	mehr_info	1.0000						
p-value								
obs		1264						
coeff (rank corr)		1.0000						
p-value								
coeff	mns_infpr	<b>0.3072</b>	1.0000					
p-value		0.0000						
obs		1204	1444					
coeff (rank corr)		<b>0.3155</b>	1.0000					
p-value		0.0000						
coeff	mns_infaut	<b>0.1905</b>	<b>0.3913</b>	1.0000				
p-value		0.0000	0.0000					
obs		624	716	732				
coeff (rank corr)		<b>0.2001</b>	<b>0.3805</b>	1.0000				
p-value		0.0000	0.0000					
coeff	mns_hhpr	<b>0.1474</b>	<b>0.0912</b>	0.0040	1.0000			
p-value		0.0000	0.0007	0.9160				
obs		1210	1384	703	1445			
coeff (rank corr)		<b>0.1633</b>	<b>0.1041</b>	0.0521	1.0000			
p-value		0.0000	0.0001	0.1676				
coeff	mns_hhkk	0.0002	-0.0336	-0.1099	<b>0.1744</b>	1.0000		
p-value		0.9963	0.4200	0.0524	0.0000			
obs		505	579	312	574	589		
coeff (rank corr)		0.0020	-0.0171	<b>-0.1139</b>	<b>0.1444</b>	1.0000		
p-value		0.9646	0.6820	0.0444	0.0005			
coeff	mns_prm	0.0295	<b>-0.1019</b>	-0.0197	-0.0249	0.0594	1.0000	
p-value		0.4519	0.0054	0.6774	0.4971	0.2665		
obs		653	745	447	746	352	772	
coeff (rank corr)		0.0285	<b>-0.1099</b>	-0.0280	-0.0041	0.0657	1.0000	
p-value		0.4670	0.0027	0.5550	0.9119	0.219		
coeff	mns_abga	-0.0044	0.0127	-0.0460	<b>0.1480</b>	-0.0263	<b>0.0934</b>	1.0000
p-value		0.9147	0.7445	0.3740	0.0001	0.6320	0.0461	
obs		585	660	376	661	335	456	680
coeff (rank corr)		-0.0047	0.0025	-0.0453	<b>0.1136</b>	-0.0259	0.0885	1.0000
p-value		0.9106	0.9489	0.3807	0.0034	0.6362	0.0591	

## Appendix 3: List of Variables

### Dependent variables:

Mehr_info –	should manufacturers give more information on energy efficient cars?
Mns_inf_pr –	more general information on how fuel consumption can be reduced
Mns_infaut –	more information on which cars have high and low fuel consumption
Mns_hhpr –	raising the price of fuel
Mns_hhkk –	raising the price of fuel and redistribution by lowering health insurance premiums
Mns_prm –	incentive of EUR 650 up to EUR 1350 for buyers of energy efficient cars
Mns_abga –	fine of EUR 1350 for those with polluting cars

### Independent variables:

Log_alter –	logarithm of age
Geschl –	sex (0 – female; 1 – male)
Hh_anzkin –	persons under 18 in household
Hh_breink –	household income categories
Ausb_obl –	completed obligatory schooling (yes/no)
Aweg_zeit –	time spent traveling to work (categories)
Kauf_anz –	whether the respondent has previously bought a car
Lk_zeit –	time taken to choose a car
Wohn_5j –	likely to live in same address in 5 years (0 if same address, 1 otherwise)
Bedt_ee_korr –	knowledge of the energy label for cars
Nk_abs –	likelihood of buying a car in the next 10 years (0 (surely not) – 3 (certainly))
Hh_autos –	number of cars in household
Dummy_vm_fuss –	travel to work on foot (yes/no)
Dummy_vm_velo –	travel to work on bike (yes/no)
Dummy_vm_auto –	travel to work by car (yes/no)
Dummy_vm_tram –	travel to work on tram (yes/no)

## Appendix 4: Regression Results

Table 7: Regression results for the information variables. Only regression results significant at the 10% level are shown for the latter results.

	mehr_info				mns_infpr				mns_infaut			
	Probit	Probit	Probit	Probit	Poisson	Poisson	Poisson	Poisson	Poisson	Poisson	Poisson	Poisson
log_alter	<b>0.2387</b>	0.2396	0.4163	<b>0.2573</b>	<b>0.0684</b>	<b>0.0763</b>	-0.0467	<b>0.0777</b>	<b>-0.1032</b>	<b>-0.1065</b>	<b>-0.2524</b>	<b>-0.0843</b>
	1.86	1.43	1.24	1.97	2.24	1.95	-0.57	2.42	-4.24	-3.47	-4.32	-3.30
geschl	<b>-0.1641</b>	<b>-0.1818</b>	0.0302	-0.0883	<b>-0.0605</b>	<b>-0.0605</b>	0.0039	<b>-0.0589</b>	-0.0042	-0.0144	-0.0279	-0.0039
	-1.81	-1.72	0.15	-0.95	-2.81	-2.38	0.08	-2.66	-0.22	-0.69	-0.86	-0.19
hh_anzkin	0.0617	0.0776	0.0854	0.0504	-0.0094	-0.0108	<b>-0.0511</b>	-0.0134	-0.0088	-0.0033	-0.0078	-0.0109
	1.42	1.63	1.09	1.14	-0.86	-0.92	-2.66	-1.29	-0.95	-0.32	-0.59	-1.17
hh_breink	-0.0040	0.0114	0.0294	-0.0330	-0.0018	-0.0045	0.0076	0.0023	0.0064	0.0054	<b>0.0183</b>	0.0035
	-0.17	0.41	0.59	-1.35	-0.32	-0.65	0.62	0.4	1.38	0.99	1.99	0.69
ausb_obl	<b>-0.2117</b>	<b>-0.2263</b>	-0.2832	<b>-0.1889</b>	0.0360	0.0371	0.0329	<b>0.0424</b>	-0.0062	0.0066	0.0388	0.0108
	-2.12	-1.93	-1.61	-1.85	1.53	1.33	0.78	1.86	-0.3	0.28	1.15	0.49
aweg_zeit			-0.0160				0.0019				<b>0.0359</b>	
			-0.22				0.1				2.99	
kauf_anz			0.5294				0.0606				<b>-0.0967</b>	
			0.92				0.63				-2.94	
lk_zeit			0.0544				0.0053				0.0066	
			0.99				0.37				0.67	
wohn_5j			-0.1362				-0.0283				<b>-0.1014</b>	
			-0.79				-0.62				-3.26	
bedt_ee_korr			<b>0.5527</b>				<b>0.0505</b>				0.0089	
			5.05				1.96				0.51	
nk_abs			0.0790				0.0122				0.0149	
			0.64				0.4				0.7	
hh_autos			<b>-0.2384</b>				-0.0208				-0.0044	
			-1.93				-0.62				-0.22	
dummy_vm_fuss		-0.1153				0.0261				-0.0615		
		-0.66				0.66				-1.59		
dummy_vm_velo		0.1576				0.0200				<b>-0.0673</b>		
		1.09				0.6				-1.83		
dummy_vm_auto		<b>-0.2833</b>				-0.0186				0.0270		
		-2.22				-0.63				1.01		
dummy_vm_tram		<b>0.2673</b>				0.0016				<b>0.0576</b>		
		1.75				0.05				1.99		
mehr_info								<b>0.2004</b>				<b>0.0706</b>
								9.56				4.21
mns_hhpr				<b>0.1731</b>				<b>0.0158</b>				0.0042
				5.34				2.14				0.6
[pseudo-JR2	0.0079	0.0292	0.1126	0.0291	0.0015	0.0020	0.0059	0.0126	0.0014	0.0029	0.0075	0.0024
OBS	1043	786	302	1005	1176	834	347	983	603	444	165	514

Table 8: Regression results for the financial incentive dependent variables. Only regression results significant at the 10% level are shown for the latter results

	mns_hhpr				mns_hhkk			
	Poisson	Poisson	Poisson	Poisson	Poisson	Poisson	Poisson	Poisson
log_alter	-0.0047	-0.0657	-0.0041	-0.0611	0.0396	0.0325	0.1438	0.0194
	-0.08	-0.91	-0.03	-0.99	1.05	0.67	1.26	0.47
geschl	<b>-0.0966</b>	<b>-0.1481</b>	<b>-0.1945</b>	<b>-0.0988</b>	<b>-0.0504</b>	<b>-0.0684</b>	-0.0429	<b>-0.0479</b>
	-2.34	-3.03	-2.21	-2.25	-1.91	-2.21	-0.63	-1.65
hh_anzkin	0.0103	0.0310	-0.0032	0.0097	0.0025	-0.0021	-0.0163	0.0047
	0.50	1.41	-0.09	0.46	0.18	-0.14	-0.65	0.34
hh_breink	<b>0.0410</b>	<b>0.0540</b>	<b>0.1016</b>	<b>0.0568</b>	<b>0.0139</b>	0.0125	-0.0132	0.0068
	3.69	4.11	4.46	4.81	1.96	1.47	-0.72	0.86
ausb_obl	<b>-0.0817</b>	-0.0676	-0.0243	-0.0554	0.0438	0.0409	0.0276	0.0423
	-1.79	-1.25	-0.30	-1.16	1.40	1.08	0.41	1.31
aweg_zeit			-0.0437				0.0248	
			-1.29				0.97	
kauf_anz			-0.0098				<b>0.1463</b>	
			-0.05				1.70	
lk_zeit			-0.0056				0.0263	
			-0.22				1.50	
wohn_5j			-0.1270				0.0531	
			-1.62				0.93	
bedt_ee_korr			0.0770				0.0011	
			1.58				0.03	
nk_abs			-0.0966				<b>-0.0891</b>	
			-1.63				-2.44	
hh_autos			<b>-0.2193</b>				0.0065	
			-3.96				0.14	
dummy_vm_fuss		-0.0993				-0.0350		
		-1.21				-0.76		
dummy_vm_velo		<b>0.1233</b>				<b>-0.0823</b>		
		2.00				-2.04		
dummy_vm_auto		<b>-0.2504</b>				0.0055		
		-4.36				0.16		
dummy_vm_tram		0.0491				0.0224		
		0.76				0.52		
mehr_info				<b>0.2281</b>				-0.0105
				5.53				-0.38
mns_hhpr								<b>0.0430</b>
								3.84
[pseudo-]R2	0.0047	0.0217	0.0342	0.0149	0.0011	0.0023	0.0060	0.0033
OBS	1170	828	293	1005	490	367	132	420

Table 8 (continued): Regression results for the financial incentive dependent variables.  
 Only regression results significant at the 10% level are shown for the latter results.

	mns_prm				mns_abga			
	Poisson	Poisson	Poisson	Poisson	Poisson	Poisson	Poisson	Poisson
log_alter	-0.0370	-0.0251	-0.0859	-0.0327	<b>0.0638</b>	<b>0.0745</b>	-0.0309	<b>0.0907</b>
	-1.31	-0.66	-1.22	-1.07	1.87	1.68	-0.32	2.47
geschl	-0.0072	0.0062	0.0261	-0.0066	0.0086	-0.0076	0.0489	0.0187
	-0.36	0.27	0.67	-0.31	0.36	-0.27	0.89	0.73
hh_anzkin	-0.0069	-0.0064	0.0100	-0.0110	-0.0162	-0.0036	0.0122	-0.0173
	-0.70	-0.59	0.68	-1.02	-1.30	-0.26	0.52	-1.27
hh_breink	0.0147	0.0085	-0.0033	<b>0.0125</b>	0.0098	0.0104	0.0180	0.0057
	2.66	1.25	-0.27	2.06	1.54	1.37	1.21	0.81
ausb_obl	-0.0289	-0.0387	-0.0202	-0.0286	-0.0230	-0.0032	-0.0562	-0.0048
	-1.35	-1.52	-0.55	-1.20	-0.84	-0.10	-1.19	-0.16
aweg_zeit			0.0207				-0.0208	
			1.23				-0.98	
kauf_anz			<b>-0.1712</b>				-0.0052	
			-3.92				-0.05	
lk_zeit			-0.0111				-0.0217	
			-0.88				-1.34	
wohn_5j			-0.0227				<b>0.1273</b>	
			-0.56				2.49	
bedt_ee_korr			-0.0023				-0.0119	
			-0.09				-0.42	
nk_abs			-0.0279				-0.0111	
			-0.98				-0.30	
hh_autos			0.0258				-0.0309	
			0.92				-0.81	
dummy_vm_fuss		-0.0377				-0.0022		
		-1.00				-0.05		
dummy_vm_velo		0.0088				0.0390		
		0.28				1.02		
dummy_vm_auto		0.0255				-0.0057		
		0.91				-0.17		
dummy_vm_tram		0.0348				-0.0064		
		1.05				-0.17		
mehr_info				0.0183				-0.0206
				0.87				-0.85
mns_hhpr				-0.0052				<b>0.0299</b>
				-0.64				3.24
[pseudo-]R2	0.0010	0.0010	0.0030	0.0008	0.0012	0.0010	0.0069	0.0029
OBS	643	470	184	538	558	421	156	481